PERSONNEL RESEARCH SERIES

PRS

PREDICTION OF FORESTER RETENTION AND ADVANCEMENT FROM THE KUDER PREFERENCE RECORD

George W. Mayeske

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George W. Mayeske

Personnel Research Staff

Office of Personnel

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SUMMARY AND HIGHLIGHTS

In 1948 through 1949, the Forest Service administered the Kuder Preference Record to 125 Junior Foresters, grades 5 and 7. Of these, 87 were still in the Forest Service in December 1962 at grades 7 to 14.

Analysis showed that:

(1) those who remained in the Forest Service had scored higher in Outdoor interests and;

(2) those who moved into the higher grade levels had scored lower in Outdoor, Scientific and Persuasive interests.

Thus, the Kuder Preference Record shows promise of being able to provide improved estimates of the future contributions of Junior Foresters to the Service.

The recently initiated experimental test research, in which the Kuder Preference Record is included, will provide the additional validity data needed to establish how much this interest test can add to the effectiveness of screening Junior Foresters, when used in conjunction with other tests and personal background characteristics.

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PREDICTION OF FORESTER RETENTION AND ADVANCEMENT FROM THE KUDER PREFERENCE RECORD

Introduction

In the period from 1948 to 1949 the Forest Service administered the Kuder Preference Record, Form C, to 125 Junior Foresters (GS 460, 5-7). Each man was scored, by the standard key, in each of the ten interest areas of this test:

1. Outdoor
2. Mechanical
3. Computational
4. Scientific
5. Persuasive
6. Artistic
7. Literary
8. Music
9. Social Service
10. Clerical

Group scores but not individual scores were made known to the regional directors. The individual scores were kept in the Washington personnel office and did not in any way influence decisions affecting these people in the ensuing years.

The Personnel Research Staff of USDA, in collaboration with the Forest Service, undertook this study to see what the relationships might be between these interest scores and aspects of these Foresters' organizational behavior.

In December, 1962, the Forest Service sent out an inquiry on those who had been tested when they were Junior Foresters to find out whether or not they were still with the Forest Service and, if so, what was their current grade (GS) level and specialty.

Test scores were validated against two criteria: (1) individuals still in the Forest Service compared with those who had left; and (2) the current GS level of those still in the Forest Service. For the retention criterion no refined documentation was made as to when or why an individual left the Forest Service. Likewise, no distinction was made as to program specialties for the current GS levels.

Retention Analysis

Analysis of the retention information (presented in Appendix A) showed that there was a significant difference* in Outdoor interests between those who left and those who remained in the Forest Service. A comparison of the average scores of these two groups is presented in Exhibit 1.

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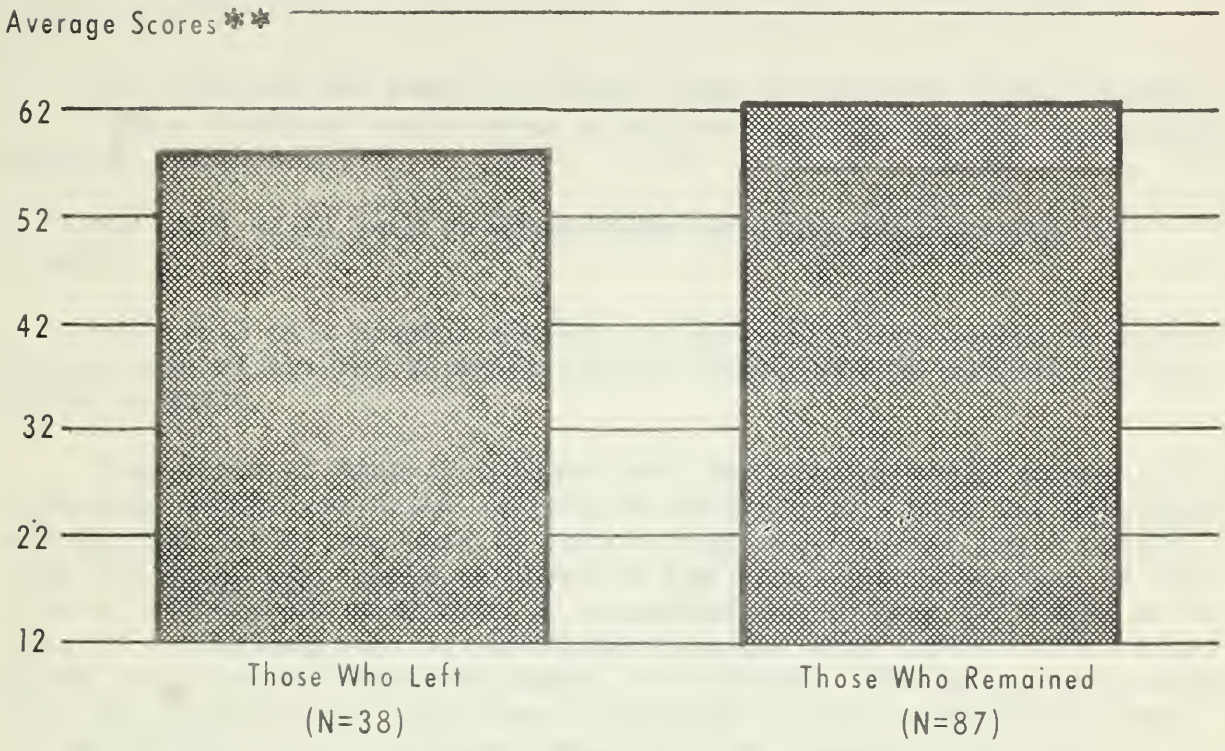
*A significant difference is one which would occur less than five percent of the time by chance.

EXHIBIT 1

Comparison of interest in outdoor activities between those who left and those who remained in the Forest Service



There were 38 men in the group that left and 87 in the group that remained. Inspection of Exhibit 1 shows that both groups are high on the Outdoor scale but that those who remained in the Forest Service averaged higher on the scale (63.0) than those who left (58.2). The difference between these groups is not sufficiently pronounced to make it practical to use this test alone as a selection device. Similar analyses should be conducted with another sample of Foresters along with additional potentially predictive test and background variables. A program to achieve this is currently underway with the Forest Service.

Rate of Advancement Analysis

The second phase of this analysis relates the individuals' scores for the ten interest scales to their current GS levels. Since these individuals all entered the Forest Service as Junior Foresters at about

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**A score of 12 is the lowest one can get on the Outdoor scale and 72 the highest.

the same time, their current GS level is interpreted as reflecting their rate of advancement. In order to evaluate this information, multiple regression analysis was employed. The manner in which multiple regression analysis utilizes information is explained in Appendix B.

The question one wants to answer from an analysis of this nature is: "Which interest scales make a critical contribution in estimating rate of advancement?"

The full scale rate of advancement analysis is presented in Appendix C.

Exhibit 2 is a graphic display of the additional amount of information each of the ten interest scales contributes in estimating rate of advancement.

Inspection of Exhibit 2 shows that the Outdoor scale accounts for 5 percent of the variation in rate of advancement. When the Persuasive and Outdoor scales are used in combination they account for 7 percent. When the Scientific scale is added to the first two, 9 percent of the rate of advancement criterion is accounted for. There is little or no gain in estimating rate of advancement by the other seven scales after these three scales have been taken into account. The multiple correlation of .33 indicates that about 11 percent of the variation in rate of advancement was the maximum that could be predicted from the 10 scales of this test, and hence there is room for improving prediction further by recourse to other kinds of information, such as ability and background measures.

Inspection of the weights in Appendix C (Exhibit 5) shows that when we compare the persons who move up into administrative work with those who stay on the forest, the "administrators" are lower in Outdoor, Scientific and Persuasive interests. (The Scientific scale actually reflects a scientific-technical interest, and the Persuasive, a persuasive-aggressive interest.)

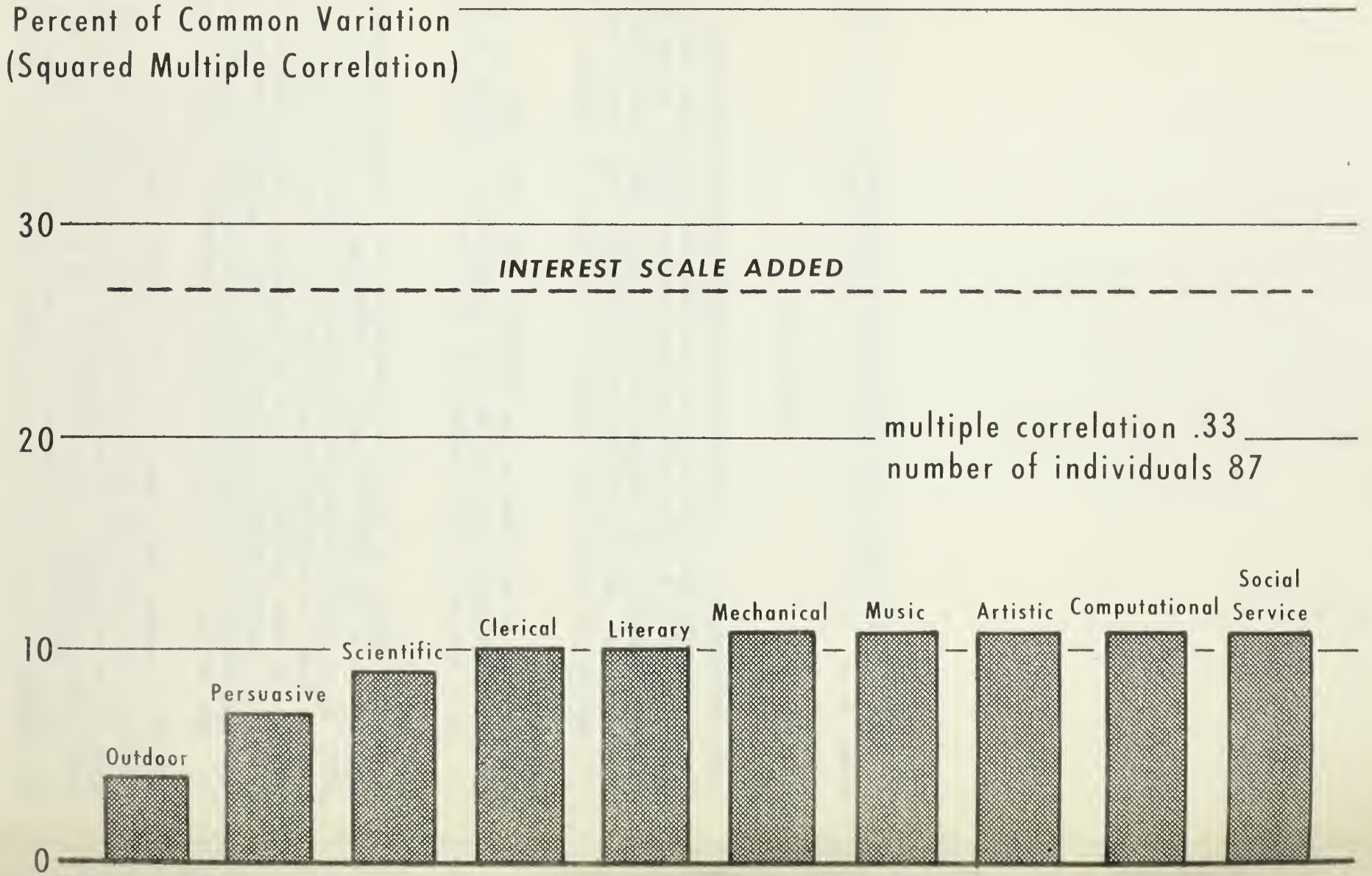
Discussion of Results

This research has two main findings: (1) those who stayed in the Forest Service, compared to those who left, were higher on the Outdoor scale and; (2) those who moved up into administrative work, compared to those who stayed on the forest, were lower on the Outdoor, Scientific, and Persuasive scales.

In a study performed by Brody, the Kuder was administered to all Foresters in the Northern Region of the Forest Service in 1950. Comparisons were made of Foresters in different organizational levels and activities at that time. By combining these activity areas according to GS level one can observe a slightly similar trend for lower Outdoor

EXHIBIT 2

Gain in estimation of advancement with increase in number of interest scales used



and Scientific interests to be associated with higher GS level but for higher Persuasive interests to be associated with higher GS level. These results suggest that the Outdoor and Scientific interests of individuals who move up into the higher GS levels may be already formed at the time they enter the Forest Service but that their Persuasive interests may alter with intervening experiences.

The success of the Forest Service's programs depends on having adequate numbers of people from which to select for the higher levels, as well as having adequate numbers who find satisfactions at the lower levels. To have too many of one or the other kind of person would tend to upset an equilibrium necessary for overall program success. Thus, if in initial selection the Forest Service were to put too much emphasis on a high Outdoor score it might well be faced with a scarcity of men who, later on, would be available and suitable for administrative positions.

This analysis lends credence to this line of reasoning since those who leave the Forest Service as well as those who advance in the Forest Service tend to be lower on the Outdoor scale than those who remain on the forest.

One of the needs made evident to management by findings of this nature, is for forecasting and specification of the numbers and types of people needed to be retained at each grade level, and then to recruit so as to provide the "optimum mix" or "blend" in the human resources inventory that will most nearly meet the short and long range requirements of effective organization functioning over all.

References

Brody, D. S. Kuder interest patterns of professional Forest Service men. Educational and Psychological Measurement, XVII (1957), 599-605.

A P P E N D I X A

EXHIBIT 3

Scale Means and Variances for Those Who Left and Those Who Remained in the Forest Service

Scale	(n = 38) Those Who Left		(n = 87) Those Who Remained	
	Mean	Variance	Mean	Variance
1. Outdoor	58.24*	131.13	63.00*	131.30
2. Mechanical	43.08	139.35	46.13	130.19
3. Computational	26.89	55.32	29.14	90.98
4. Scientific	43.05	164.21	46.00	77.65
5. Persuasive	33.78	133.06	29.37	140.00
6. Artistic	24.46	86.47	22.06	64.94
7. Literary	23.19	59.66	22.00	42.02
8. Music	10.14	46.29	10.60	32.05
9. Social Service	39.72	110.92	40.55	140.70
10. Clerical	40.18	142.60	38.78	101.45

*$p < .05$ i.e. the difference between these means would occur less than 5 percent of the time by chance.

Mean - The arithmetic average obtained by adding up all of the scores and dividing this by the total number of scores.

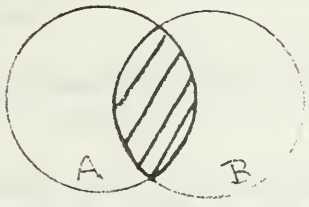
Variance - A measure of the extent to which scores vary about the mean (or average score).

A P P E N D I X B

THE UTILIZATION OF INFORMATION IN MULTIPLE REGRESSION ANALYSIS

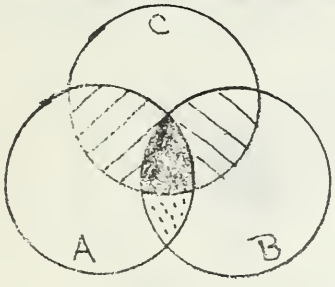
The manner in which this mathematical technique utilizes information is best illustrated by means of a few simple diagrams.

Suppose that we have two categories of information that are of interest to us. These can be represented by means of two overlapping circles or sets labeled A and B. The area of overlap, the shaded area, represents that information which is common to both A and B.



Suppose we wanted to add up everything in A and B by adding first everything in A and then everything in B. In doing this we would have counted everything in the shaded area twice, once when counting A and once when counting B. In order to be correct in our arithmetic we only want to count the shaded area once, hence we would subtract it once (A + B = A + B - ▨).

Now let us complicate the picture a little by introducing a third set C,



and let us define the following areas:

● - that information in the intersection of all three sets.

\\\ - that information common to B and C which A doesn't have.

/// - that information common to A and C which B doesn't have.

⁘ - that information common to A and B which C doesn't have.

If we wanted to add up everything in all three sets, A + B + C, we would end up counting the dotted and slanted areas twice each and the solid area three times. To correct for this we would want to subtract the dotted and slanted areas once each and the solid area twice, i.e. A + B + C - ▨ - ▨ - ▨ - 2●.

We could make the picture increasingly complex by adding more sets of information, however, this simple example is sufficient. Let us ascribe some meaning to these categories of information.

Let us now assume that A, B and C are three measures on a group of people.

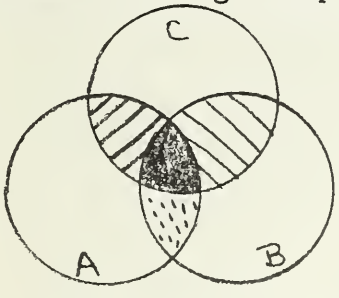
A - Score for each person representing his interest in Outdoor activities

B - Score for each person representing his interest in Mechanical activities

C - Score representing each person's rate of advancement (i.e., GS 9, 11, etc.)

In this context multiple regression analysis would attempt to ascertain the manner in which categories A and B are combined to arrive at each individual's rate of advancement score. The outcome would be a set of weights assigned to each interest scale so that when combined they estimate as closely as possible each individual's rate of advancement score. The weights are assigned to these categories so as to maximize their relationship with rate of advancement and minimize the amount of overlap between these scales.

Thus, in the following example:



If A were counted first, then it would be given the largest weight. This weight would count the solid area as part of A and then in assigning a weight to B the solid area would not be counted again. Thus, B would play a much smaller part in determining C than would A.

An individual's A score would then be multiplied by the weight for A, his B score by the weight for B, and then these two weighted scores would be summed in order to arrive at an estimated C score. A measure of the adequacy with which the C scores are estimated by this weighting system is called the multiple correlation. This value varies from 1.00 for perfect estimation to .00 for lack of any relationship.

A P P E N D I X C

EXHIBIT 4

Correlations Amongst Scales and Between Each Scale and Grade Level

		1	2	3	4	5	6	7	8	9	10	r*
1.	Outdoor		.19	.03	.12	-.39	-.04	-.09	-.18	.03	-.26	-.21
2.	Mechanical	.19		.00	.08	-.40	-.09	-.18	-.17	-.45	-.02	.06
3.	Computational	.03	.00		.12	-.26	-.09	-.05	-.02	-.22	.31	.04
4.	Scientific	.12	.08	.12		-.22	-.20	-.14	-.29	.10	-.20	-.13
5.	Persuasive	-.39	-.40	-.26	-.22		-.03	.03	.06	.30	-.02	-.07
6.	Artistic	-.04	-.09	-.09	-.20	-.03		.10	.02	-.24	.02	.01
7.	Literary	-.09	-.18	-.05	-.14	.03	.10		.02	-.18	-.20	.07
8.	Music	-.18	-.17	-.02	-.29	.06	.02	.02		-.22	.03	.03
9.	Social Service	-.03	-.45	-.22	.10	.30	-.24	-.18	-.22		-.40	-.13
10.	Clerical	-.26	-.02	.31	-.20	-.02	-.02	-.20	.03	-.40		.20
	Mean**											11.74
	Variance**											1.77
	N = 87											

*r denotes the correlation of each scale with grade level.

**the means and variances for the other scales are given in Table 1, Appendix A, under Those Who Remained.

EXHIBIT 5

Squared Multiple Correlation and Raw Score Weights for Each Step in Selecting Scales Which Contribute Most to Estimation

		Weights for Addition of Next Best Scale on Each Trial									
		1	2	3	4	5	6	7	8	9	10
1.	Outdoor	-.023	-.030	-.030	-.026	-.025	-.025	-.026	-.026	-.026	-.026
2.	Mechanical						.007	.006	.006	.006	.004
3.	Computational									-.003	-.003
4.	Scientific			-.022	-.018	-.017	-.016	-.018	-.019	-.018	-.019
5.	Persuasive		-.020	-.023	-.021	-.020	-.017	-.018	-.018	-.019	-.019
6.	Artistic								-.005	-.005	-.006
7.	Literary					.011	.013	.013	.013	.013	.012
8.	Music							-.008	-.008	-.008	-.010
9.	Social Service										.000
10.	Clerical				.014	.017	.018	.017	.016	.018	.016
	Squared Multiple Correlation	.04	.07	.09	.10	.10	.11	.11	.11	.11	.11